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ABSTRACT

Each of 64 kindergarten children in an international day school (a Western-oriented educational program for foreign national students in Taipei, Taiwan) were administered original and revised forms of the Developmental Indicators for the Assessment of Learning (DIAL and DIAL-R), two tests widely used in early childhood screening. Of the 24 items in DIAL-R, 18 are revised from DIAL, three are unchanged, and three are new. All of the new items and most of the revised items were designed to accommodate the extension of the age range down to 2-0 from 2-6 and up to 5-11 from 5-5. Findings imply that (1) significantly high overall correlations between DIAL and DIAL-R support the expectation that longitudinal research on DIAL-R will have at least as high predictive validity as DIAL, if not higher; (2) DIAL extrapolations are not useful and should not be employed; (3) the DIAL scoring rule for the communications area is too stringent for a heterogeneous population; (4) DIAL-R is more appropriate than DIAL for screening kindergartens in which many children are over 5 years and 5 months of age; and (5) scoring DIAL-R by areas rather than by total score drastically decreases the number of children identified as "potential advanced" and slightly increases the number of children identified as "potential problem." (RH)

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Correlations Between DIAL and DIAL-R:
Implications for Early Childhood Screening

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Abstract

Using a counterbalanced design, 64 kindergarten children in an international day school were each administered DIAL and DIAL-R, two widely used early childhood screening tests. Results led to five implications: 1) correlations between the two tests are significantly high to expect DIAL-R to have at least as high predictive validity as DIAL; 2) DIAL extrapolations are not useful and should not be employed; 3) the DIAL scoring rule for Communications is too stringent for a heterogeneous population; 4) for screening kindergartens where many children are over age 5-5, DIAL-R is a more appropriate test than DIAL; and 5) scoring DIAL-R by areas rather than by total score may affect the numbers children identified as 'potential problem' and 'potential advanced'.

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Correlations between DIAL and DIAL-R:

Implications for Early Childhood Screening

Screening is the first step towards the identification of young children with special needs. Therefore, it is important to use screening tests that are adequately normed, reliable, and valid. Although there are hundreds of preschool and kindergarten screening tests (Dykes, Strickland, & Munyer, 1979; Lerner, Mardell-Czudnowski, & Goldenberg, 1981), Lichtenstein & Ireton (1984) have singled out five tests which meet the essential criteria for developmental screening; one of these five is Developmental Indicators for the Assessment of Learning (DIAL). In addition, they note that DIAL and the Denver Developmental Screening Test are the best known and currently most widely used of these five tests.

DIAL was normed in 1972 on over 4400 children in Illinois (Mardell & Goldenberg, 1972; Mardell & Goldenberg, 1975a, 1975b), and has recently been revised. The basic goal of DIAL-R, Developmental Indicators for the Assessment of Learning-Revised (Mardell-Czudnowski & Goldenberg, 1983, 1984) was to retain the best elements of DIAL while improving the content, materials, and procedures where such improvements were warranted. Three changes had a pervasive effect on the test construction: standardization on a national sample; extension of the age range down to 2-0 from 2-6 and up to 5-11 from 5-5; and the combining of Gross Motor and Fine Motor items into one Motor area. However, the similarities between the two tests appear to be greater than the differences. Of the 24 items in DIAL-R, 18 are revised from DIAL, 3 are unchanged, and 3 are new. All of the new items and most of the revised items were designed to accommodate the extended age range.

Due to the wide acceptance of DIAL, it is important to ascertain the correlation between DIAL and DIAL-R. This is particularly relevant because research on DIAL had established predictive validity of .68 over a two year span based on a sample of 249 children (Hall, Mardell, Wick, & Goldenberg, 1976). Thus, the first purpose of this study was to determine the correlations between DIAL and DIAL-R. Currently no other DIAL/DIAL-R studies have been conducted. A second purpose was to determine which of these two tests was a better screening tool for a particular population. A third purpose was to investigate the ramifications of two ways of determining the DIAL-R decision: 1) by utilizing the total score or 2) by utilizing area scores.

Sample

This study was conducted in the kindergartens of an independent coeducational day school which offers a Western-oriented educational program to foreign national students in Taipei, Taiwan. This means that Taiwanese children can attend only if they were born abroad or hold a foreign passport. Classes are conducted in English and most of the faculty are American, but there is an extensive ESL program similar to those found in most large American cities.

All kindergarten children (N=65) were included in the study. One child was on home leave during the second testing so he was eliminated from the study, leaving a total of 64 children. There were four classes, two in the morning and two in the afternoon.

The sample was very heterogeneous. Table 1 shows where the children were born and the number of years they had lived in Taiwan. Forty-nine percent of the children were Caucasian, 39% were Oriental, and 17% had Caucasian-Oriental parentage.

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Table 1 about here

According to school entrance interviews, 39 children (60.9%) were from monolingual homes while 25 children (39.1%) were from bilingual families. There were 41 boys (64%) and 23 girls (36%). The mean age was 66.6 months ($SD=4.1$) with a range from 59-76 months. The educational level of the parents was quite high. Over 84% of the fathers had a college degree (51.6% even had an advanced degree) while 61% of the mothers had a college degree (14.1% even had an advanced degree).

Method

Using a counterbalanced design, DIAL and DIAL-R were administered to each child with a 14-day interval. Both DIAL and DIAL-R are administered by multiple testers, one for each area of the test. There are four areas in DIAL and three areas in DIAL-R. Two teams were established to permit a 'blind' study. However, the tester in the Gross Motor area of DIAL also administered the Motor area of DIAL-R. Thus, there were six different testers, instead of seven, collecting data. The testers were all trained by one of the tests' co-authors.

All but two children (twins from Paraguay who only spoke Spanish) were tested in either English or Chinese, depending upon which language was reported as dominant by their parents. If a tester spoke only English, a kindergarten aide translated the items and the responses for children who were Chinese-dominant. It was assumed that the seven children whose primary language was of European origin had enough English or Chinese as a second language for testing purposes.

Results and Discussion

Table 2 shows the means and standard deviations for DIAL and DIAL-R scaled scores. The children scored lower in the Communications/Language areas than the other areas of both tests and the variability in these two areas was also the greatest, 3.3 and 5.9 standard deviations, respectively. This is probably a reflection of the multiple languages to which the children are exposed. Even in monolingual English-speaking homes, the children are most likely in contact with a Chinese-speaking amah (housekeeper) and are exposed to Chinese in the community and on television. In monolingual Chinese-speaking homes, the children have to deal with dialects (e.g. Mandarin, Taiwanese, Cantonese) and may have attended an English preschool. There is a strong desire by most parents who send their children to this school for their children to acquire both English and Chinese, even if the parents speak only one of the languages.

Table 2 about here

It is necessary to mention here comparison data from the normative samples of DIAL and DIAL-R. The means of all scores except Communication and Language are higher than the normative comparison data, probably reflecting the high educational levels of the parents. On the other hand, the means of both Communications and Language are lower while the standard deviations are larger, reflecting the variability of this particular population.

Table 3 shows the correlations between the various areas on DIAL with the corresponding areas of DIAL-R. Whereas the Concepts, Language/Communications, and Total scores are highly correlated (.67, .77, .75, respectively), ($p < .001$), the Gross Motor and Fine Motor areas of DIAL are significantly correlated with

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the Motor area of DIAL-R at only .30 ($p < .05$). This is probably due to the fact that the Gross Motor and Fine Motor items of DIAL were combined into one Motor area on DIAL-R. In the process, four items on DIAL were deleted, one new item added, and all but one item revised for the extended age range. In addition, this correlation may be spuriously low due to range restriction. On the other hand, the Communications/Language correlation may be spuriously high because of the greater variability in the scores of this sample. Even so, the first implication for this study is that overall correlations between DIAL and DIAL-R are significantly high to expect that longitudinal research on DIAL-R will have at least as high predictive validity as DIAL, if not higher.

Table 3 about here

The second purpose of this study was to determine which of these two tests was a better screening tool for this population. This became apparent almost immediately due to two problems with DIAL. First of all, DIAL was normed only to age 5-5. However, scores were extrapolated up to age 6-2. When using these extrapolations (and extrapolating still further for children beyond 6-2 up to 6-6), 37 children (57.8%) were identified as 'follow-up' or having a potential problem. Since DIAL was designed to identify only 10% of the population, the second implication is that DIAL extrapolations are not useful and should not be employed.

Of the 37 children identified as having a potential problem, 23 (62.2%) were beyond the normed age range. If these 23 children are screened with DIAL but the extrapolations are not used, 13 are still identified as having a potential problem. This leads to the second problem with DIAL.

DIAL is scored by comparing the child's score in each of the four areas to an age and sex appropriate cut-off point. The Communications area is given extra weight with the rule that even if a child is below the cut-off point only in Communications, the child should be referred. When screening a heterogeneous sample such as this one where over 39% come from bilingual homes and all are exposed to multiple languages, this rule is too stringent (i.e. it does not allow for a child's strengths in the other three areas to compensate for the Communications score). If the rule that applies for the rest of the test is employed (i.e. if the child is down in only one of the four areas, the child is O.K.), only ten children (15.6%) would have been referred. The implication here is that the DIAL scoring rule for being below the cut-off point only in Communications is too stringent for a heterogeneous populations where many languages are spoken.

DIAL-R, on the other hand, was normed for an older population. Thus only ten children were beyond the normed age group. In addition, DIAL-R does not over-emphasize the score in the Language area. The implication here is that for screening kindergartens where many of the children are over age 5-5, DIAL-R is a more appropriate screening test than DIAL.

We now turn to the third purpose of this study: the ramifications of using a DIAL-R total score or DIAL-R area scores. When DIAL-R was published in 1983, the decision was made to use only the total score because 1) since it is based on all 24 items, the total score must be more reliable than area scores; 2) correlation coefficients between DIAL-R subtests were all very high, ranging from .77 between Motor and Language to .85 between Motor and Concepts; and 3) factor analysis identified only two factors: the Motor and Concepts areas composed the first factor and the Language area composed the second factor.

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However, some users of the DIAL-R total score report that it overidentifies children in the advanced category (i.e., 1.5 standard deviations above the mean) and may mask a potential problem. In such cases, the use of area scores may be more appropriate. The DIAL-R authors are recommending that a child be on or below/above the cut-off point in two of the three DIAL-R areas before being designated 'potential problem' or 'potential advanced'. The only exception would be a child who has one score which is extreme and therefore significantly discrepant from the particular cut-off point in question.

These two DIAL-R scoring systems, by total and by areas, were applied to the sample of 64 kindergarteners. Table 4 shows the relationship between the two scoring systems and the three possible decisions.

Table 4 about here

There is agreement on 43 (67.2%) of the 64 children. Scoring by areas identifies 4 more 'potential problems', 1 more 'potential advanced', but 16 fewer 'potential advanced' than scoring by the Total score. In all categories, scoring by areas seems more appropriate. For example, identifying 6 children (9.4%) as 'potential problem' instead of 2 (3.1%) appears to be a manageable and reasonable referral rate. Likewise, identifying 11 children (17.2%) of this population rather than 40.6% as 'potential advanced' is also a manageable and reasonable referral rate. School records indicate that children attending this school score, on the average, one standard deviation above the mean on group ability and achievement tests. Based on this fact and the high educational level of the parents, one would expect to identify an increased number of 'potential advanced' children. However, it is not reasonable to identify 40.6%. Therefore, the

final implication of this study is that scoring DIAL-R by areas rather than by total score drastically decreases the number of children identified as 'potential advanced' and slightly increases the number of children identified as 'potential problem'.

While these five implications must be replicated by further research, particularly longitudinal in nature, they may serve an important function for those sites currently screening kindergarten and/or heterogeneous populations with DIAL or DIAL-R.

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Table 1

Birthplace and # of Years in Taiwan

<u>Birthplace</u>	<u># of Years</u>				Total	%
	Less than 1	1	2-4	5 or more		
U. S./Canada	9	7	6	5	27	42.2
Taiwan	1	0	0	7	8	12.5
Europe	1	1	2	0	4	6.3
Asia	2	8	2	2	14	21.9
Cent./So. Amer.	2	2	2	0	6	9.4
Other	3	1	1	0	5	7.8
N	18	19	13	14	64	
%	28.1	29.7	20.3	21.9		100.0

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Table 2

Means and Standard Deviations for DIAL and DIAL-R Scores (N = 64)

		<u>M</u>	<u>S.D.</u>
DIAL ^a	Gross Motor	19.1	1.7
	Fine Motor	19.6	1.0
	Concepts	19.5	1.7
	Communications	17.0	3.3
	Total	75.2	5.3
DIAL-R ^b	Motor	26.3	2.8
	Concepts	25.7	4.0
	Language	23.6	5.9
	Total	75.5	9.8

^a subscore max. = 21; total max. = 84

^b subscore max. = 31; total max. = 93

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Table 3

Correlations Between DIAL and DIAL-R Scores

		DIAL-R			
		Motor	Concepts	Language	Total
DIAL	Gross/Fine Motor	.30*			
	Concepts		.67***		
	Communication			.77***	
	Total				.75***

* $p < .05$

*** $p < .001$

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Table 4

Relationship of the Two DIAL-R Scoring Systems

		by DIAL-R Total				
		-1.5 <u>S.D.</u>	O.K.	+1.5 <u>S.D.</u>	N	%
by DIAL-R areas	-1.5 <u>S.D.</u>	2	4	0	6	9.4
	O.K.	0	31	16	47	73.4
	+1.5 <u>S.D.</u>	0	1	10	11	17.2
	N	2	36	26	64	
	%	3.1	56.3	40.6		100.0